

Lighting and Controls Supplier Summit

Commercial Lighting Solutions



Lighting and Controls Supplier Summit
Las Vegas, Nevada
May 11, 2010

Carol Jones
Pacific Northwest National Laboratory

CLS Delivers Additional Efficiency

3 ... and
controls

Lighting Controls

- Daylight Harvesting
- Scheduling
- Scene Control
- Vacancy Sensors
- Personal Control
- Demand Response

1. Traditional lighting efficiency approaches are component based, e.g., lamps and ballasts.

Design

- Neighborhoods of Light
- Pendant Suspension
- On-Center Spacing
- Ballast Factor Tuning
- Room Surface Brightness

4 ... and
expert
design
strategies

Equipment

- **High Performance Lamp**
- **High Performance Ballast**
- High Performance Luminaire

2. CLS includes luminaires (fixtures) ...

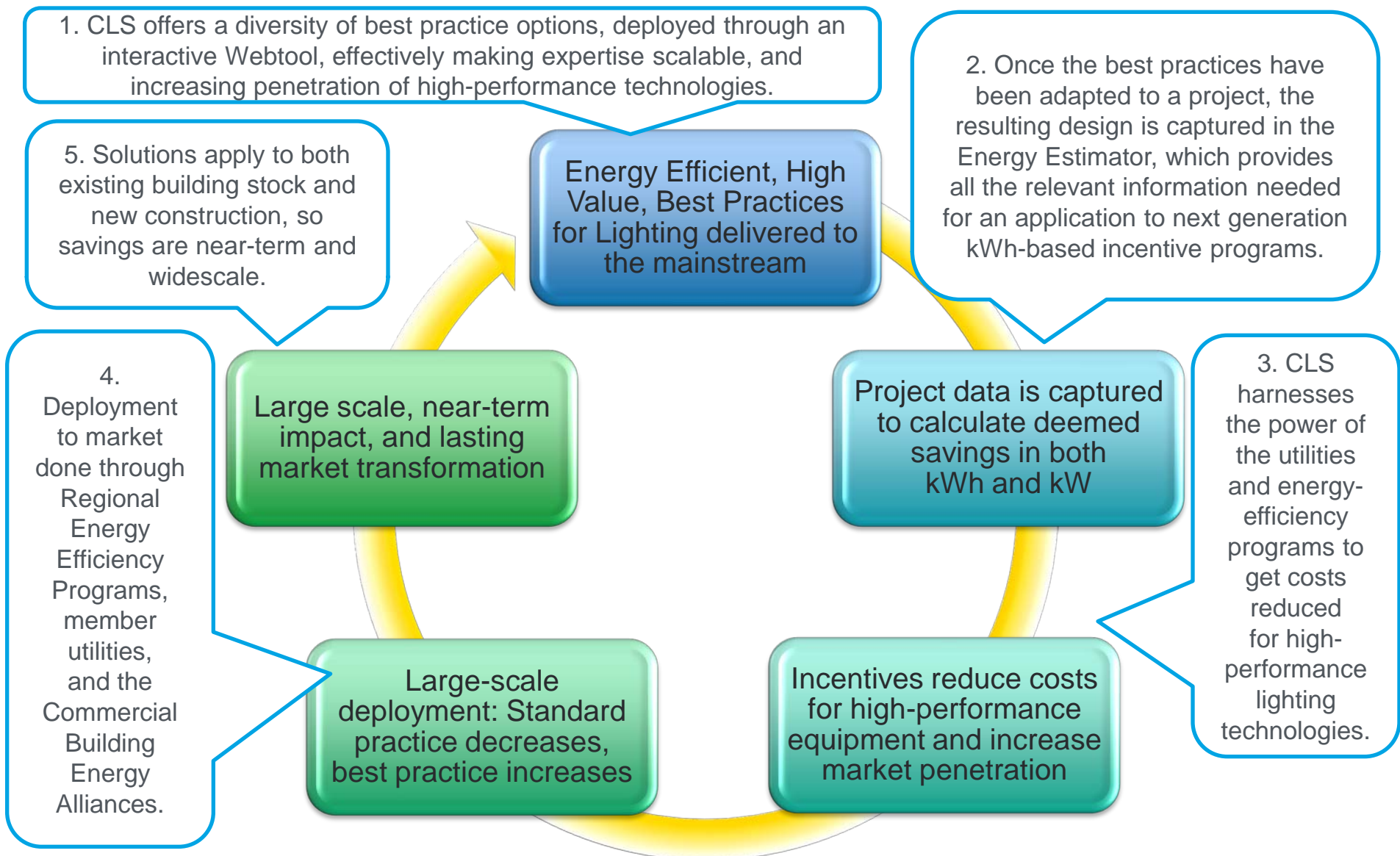
Interior Conditions

- *Reflectances*
- *Space Geometry*
- *Workstation Height and Size*
- *Window Wall*

Lighting
Energy
Efficiency
Opportunities

5. CLS includes ALL aspects of lighting energy efficiency (except for interior conditions) into a series of integrated designs, leaving nothing on the table.

CLS Impact — Causal Diagram



Power density to kilowatt hours

- Lighting power density (LPD) focuses on power (kW), not time, and cannot account for savings from controls
 - Limited to installed equipment
 - Does not address building actually operating
- Path forward must include combination of controls as well as reduced LPD
 - Reduce operating power (e.g., dimming)
 - Curtail operation (e.g., occupancy sensors, time clocks, etc.)
- CLS has a role in increasing usage of kWh-based utility and energy-efficiency program rebates

Webtool tracks energy savings

- Energy savings are shown against user-chosen baseline as they make selections
- Real-time tracking shows savings from daylighting and controls
- Uses various baselines to show energy savings against goals
- Current baselines include Std. 90.1, IECC, Title 24



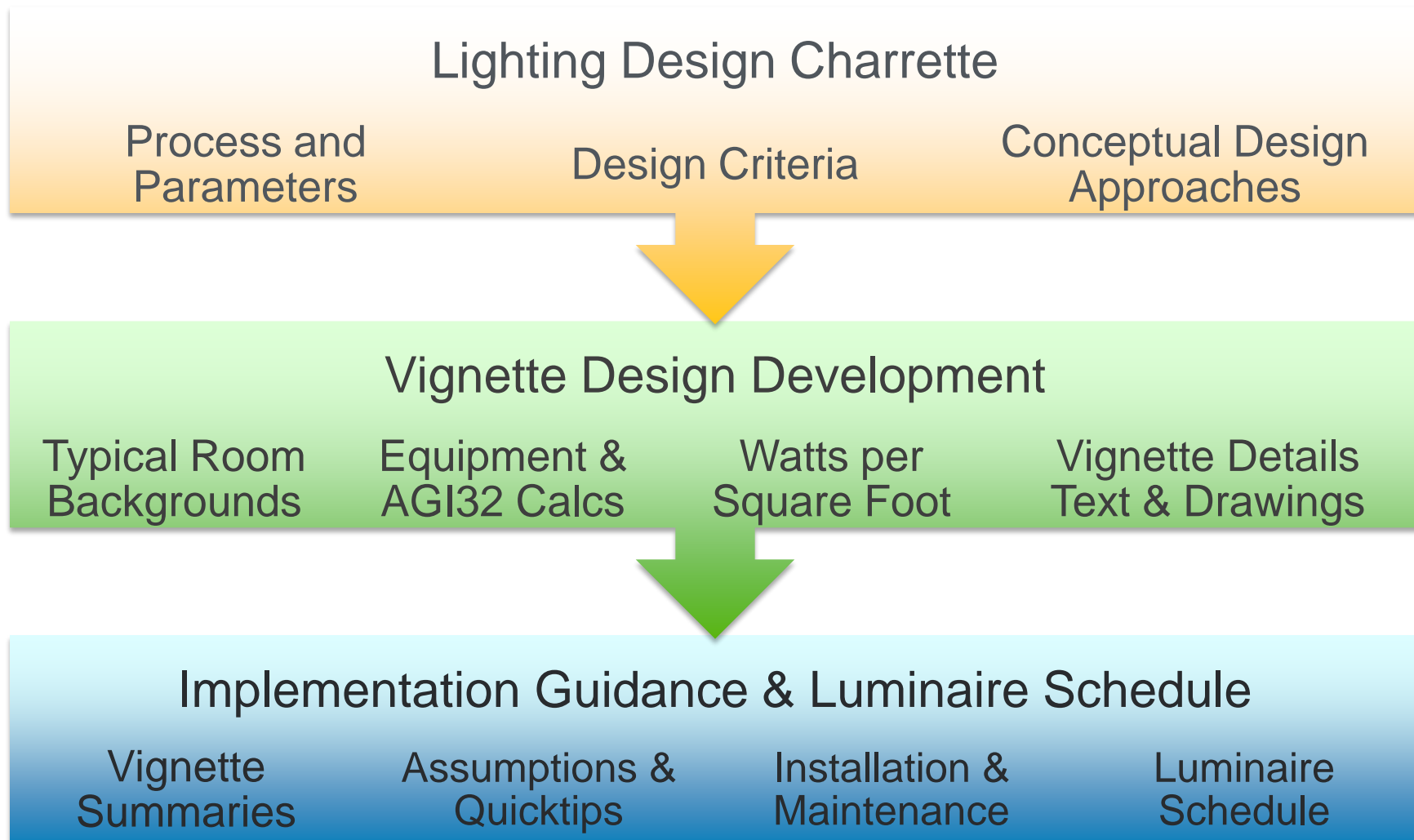
- Does not cover all spaces; we have picked spaces that are typical and applicable
- This tool does not replace professional services, it just moves the needle to provide a very efficient strawman as a starting point to help leapfrog the learning curve
- We can only analyze what has been measured
 - Reliable data measuring energy savings from lighting control systems is not easy to come by, and we won't make promises that can't be verified from solid data and reliable sources
- We are (always) seeking more data on lighting controls installations

- New Energy Estimator allows user to add actual project data
- End-user provides luminaire schedule with controls data, and tool will calculate projected savings
- Allows for design flexibility, accuracy
- Similar to documentation provided for custom programs
- Working with numerous utilities to determine their requirements for using CLS within their programs
- Goal is to break free of the component-based approach into supporting integrated systems, with a reliable process, tool, measurement, and evaluation
- kWh-based rebates, with a “how-to” that mitigates risk to the consumer and promotes best practices

GSA's Recovery Act relighting approach

- GSA is using CLS best practices as the basis for their relighting approach for Recovery Act projects
- Committed to deep energy efficiency, lighting quality, and improvement to the infrastructure of government buildings
- CLS team prepared language for GSA Recovery Act relighting, including performance criteria, input to scope and task descriptions, and the following specifications:
 - Specifications for interior lighting
 - Interior lighting control system
 - Bi-level stairwell
 - LED parking lot lighting
 - Parking garage lighting
- Issued by GSA to the regions in June 2009

Process Overview — Vignette Development



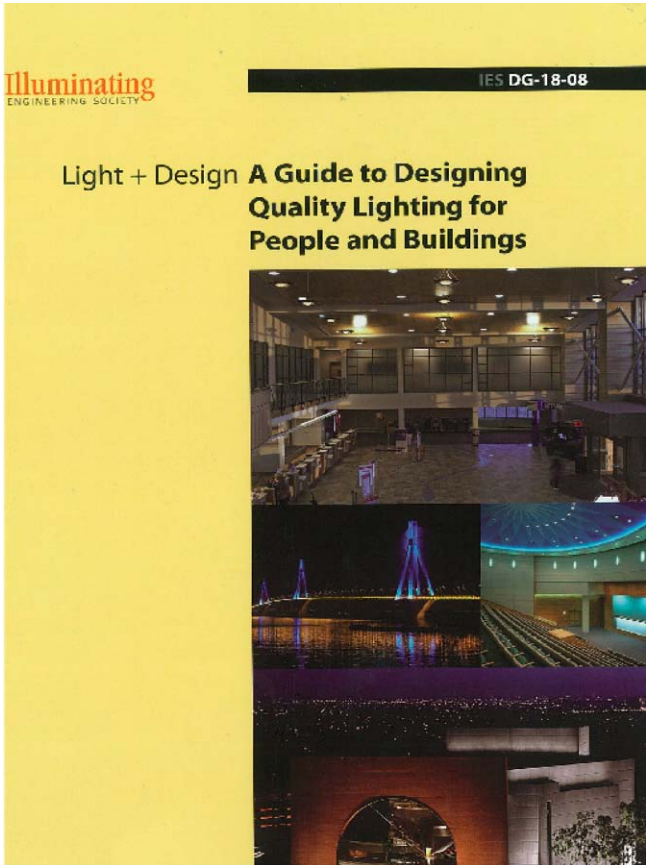
Luminaire Systems Selected



- Recessed high performance
- Direct/indirect
- “Workstation-specific”



Establish quantity and quality criteria



IESNA Lighting Design Guide

Interior-13

I. INTERIOR LOCATIONS AND TASKS		Very Important	Important	Somewhat important	Blank = Not important or not applicable																					
		Design Issues	Appearance of Space and Luminaires	Color Appearance (and Color Contrast)	Daylighting Integration and Control	Direct Glare	Flicker (and Strobe)	Light Distribution on Surfaces	Light Distribution on Task Plane (Uniformity)	Luminances of Room Surfaces	Modeling of Faces or Objects	Point(s) of Interest	Reflected Glare	Shadows	Source/Task/Eye Geometry	Sparkle/Desirable Reflected Highlights	Surface Characteristics	System Control and Flexibility	Special Considerations	Notes on Special Considerations	Illuminance (Horizontal)	Category or Value (lux)	Illuminance (Vertical)	Category or Value (lux)	Notes on Illuminance - see end of section	Reference Chapter(s)
Offices (13)																									Ch. 11	
Filing (see Reading)																						E		C		
General and private offices (see Reading)																										
Open plan office																										
Intensive VDT use																			(14,15)		D		B			
Open plan office																										
Intermittent VDT use																			(14,15)		E		B			
Private office																					E		B			
Libraries (see Libraries)																										
Lobbies, lounges, and reception areas																						C		A		
Mail sorting																						C		A		
Copy rooms																						C		A		
Parking Facilities (see Section III, Outdoor)																									Ch. 22	
Post Offices																									Ch. 11	
Lobby																			(1)		C		A			
Customer service counter																			(1)		E		A			
Mail processing, general																			(1)		E					

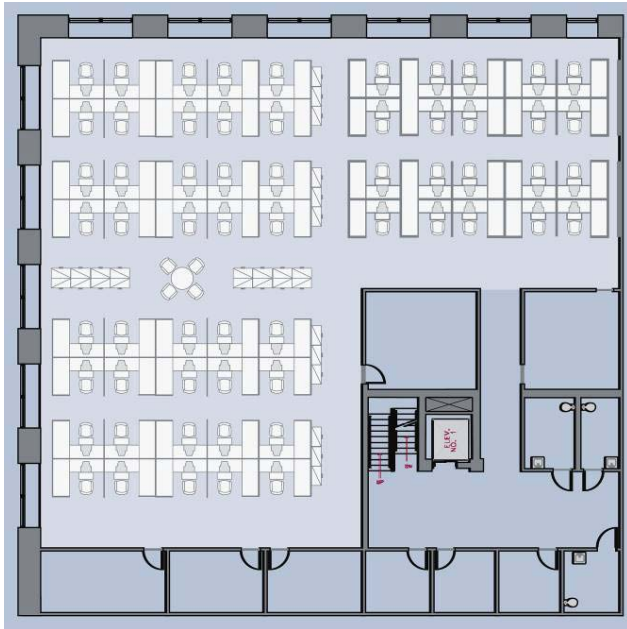
Space types

- Open plan
- Open plan perimeter (wall washing)
- Private offices
- Conference rooms
- Corridors
- Reception

The screenshot displays the 'Commercial Lighting Solutions' web application interface. At the top, the header includes the U.S. Department of Energy logo and the text 'Energy Efficiency & Renewable Energy'. Below the header, a navigation bar shows the user is logged in as 'carol.jones@pnl.gov' with links for 'Log Out', 'Settings', and 'Help'. A search bar contains the text 'test', and buttons for 'Save', 'Copy', 'New Project', 'Select a project...', and 'Load Project' are visible. The main content area is titled 'Office Design Vignettes' and instructs the user to 'Select the spaces your building will include.' A diagram shows a selection of space types: 'Private Offices' (with a briefcase icon), 'Open Plan' (with a cross-hatch icon), 'Open Plan Perimeter' (with a dashed rectangle icon), 'Corridors' (with a double-headed arrow icon), 'Conference Rooms' (with a group of people icon), and 'Reception' (with a smiley face icon). A sidebar on the right contains a 'PROJECT DESCRIPTION' section with 'Office' selected and a 'DESIGN VIGNETTES' section. At the bottom, a status bar shows a dropdown for '90.1-2007' with a link 'What's my code?', and energy metrics: 'Baseline: 0 kWh', 'Proposed: 0 kWh', and 'Energy Savings: 0%'. Navigation buttons 'Back' and 'Next' are also present.

Typical Room Selection (CAD Backgrounds)

- Prototypical — not too perfect, not too odd
- Perimeter or interior
- Cubicle density = total sf of room / # of workstations



High density



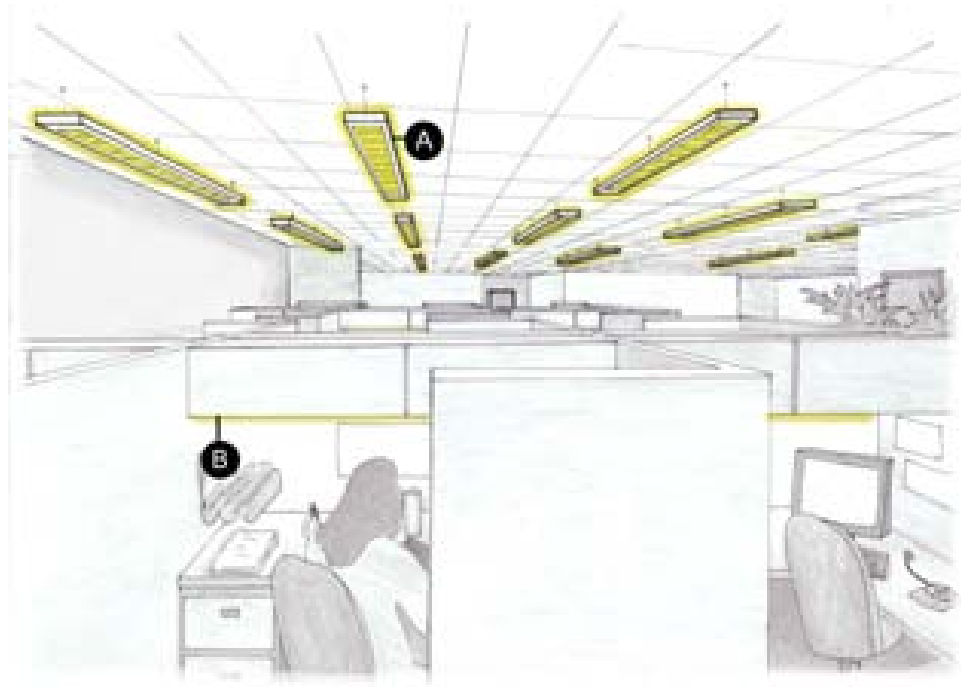
Medium density

Open plan partitions

- Partition heights: 48", 56", 64"



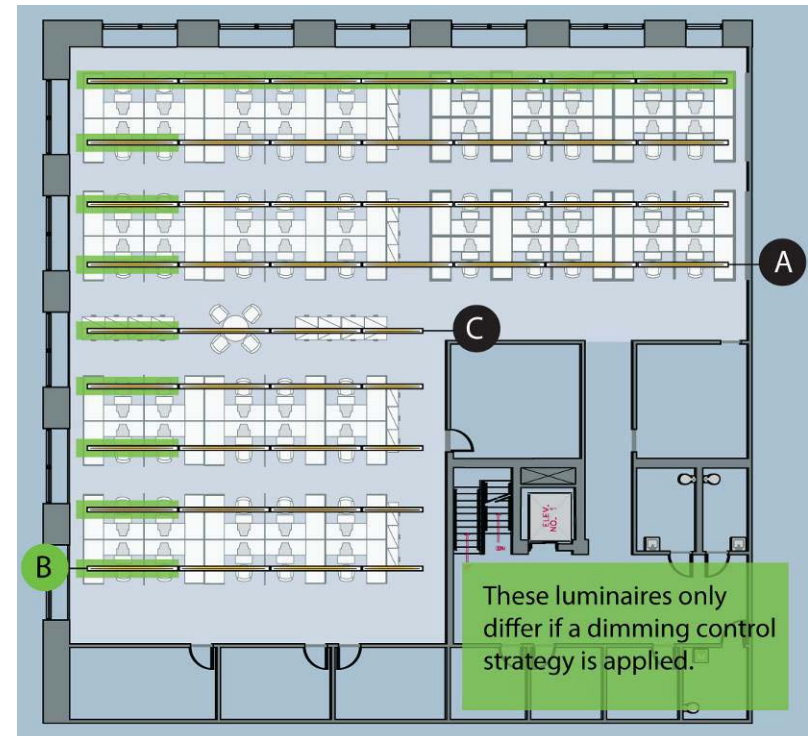
42" high



64" high

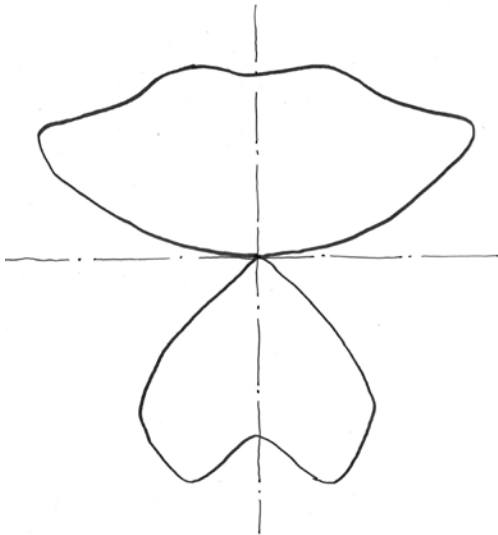
Design Process

- Iterative process of design and calculation
- Selected for efficiency, quality, cost, controls



Luminaire Selection Procedure

- Looked at 6–8 products in each category
- Chose top 3 (T8) luminaires for energy and quality
- Used third best for calculations
- Wrote performance specifications



Open plan — Three conceptual approaches

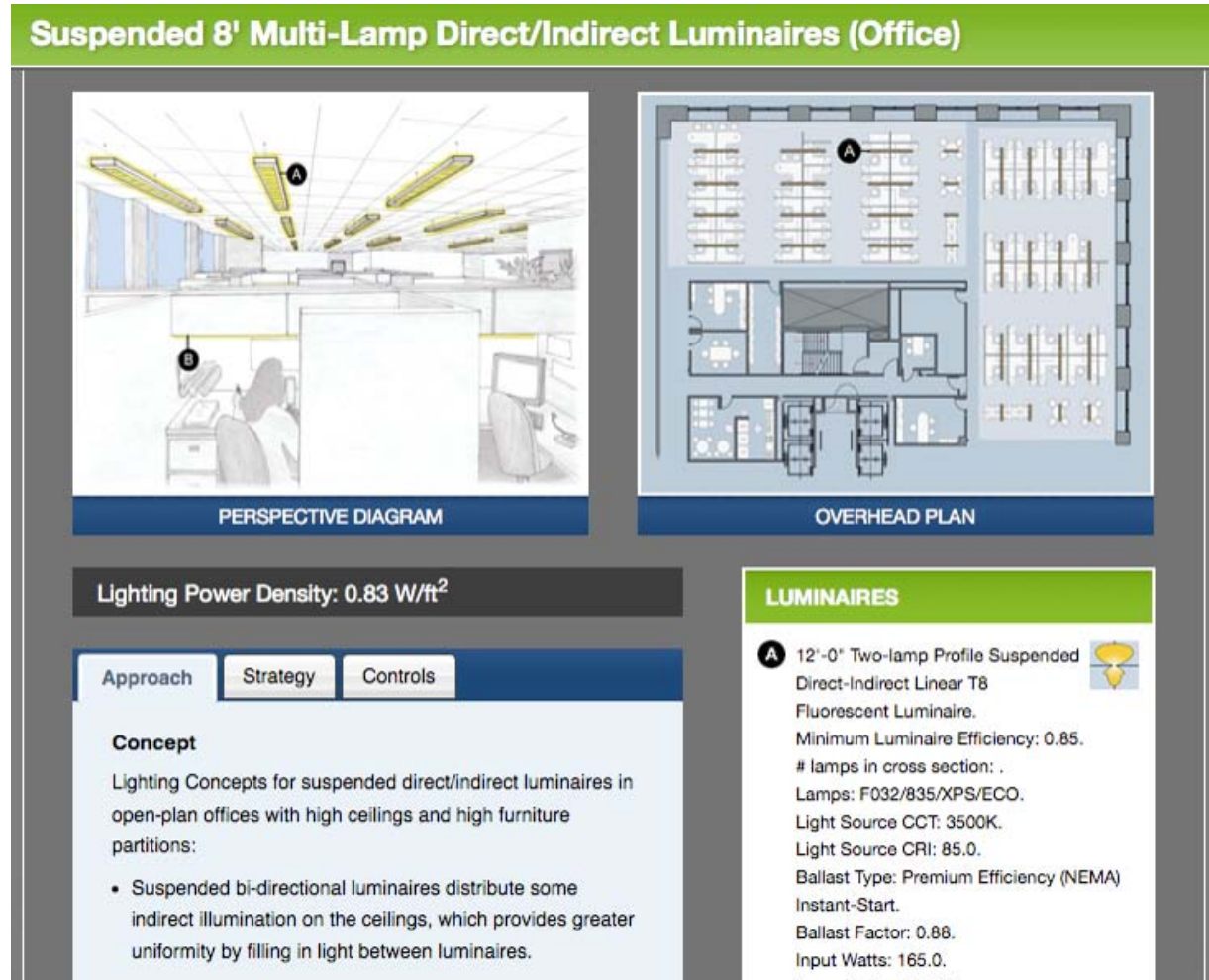
1. Recessed high performance
2. Pendant direct/indirect
3. Workstation specific



→ Others may follow

Vignette details: Screen text and drawings

- Perspective
- Plan view
- Watts/square foot
- Approach
- Strategies
- Controls
- Luminaire details



Implementation guidance report

- Vignette summary details
- Vignette implementation
- Control guidance



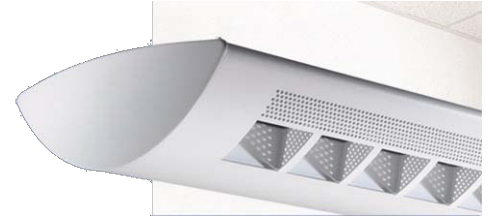
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Vignette Summaries and
Implementation Instructions

Luminaire schedule

- Performance spec language



Luminaire Schedule

Example Demonstration

Fixture Label	Description	# lamps in cross section	Lamps	Light Source CCT	Light Source CRI	Initial Lamp Lumens	Ballast Type	Ballast Factor	Input Watts	Lamp/Balast MLPW	Minimum Luminaire Efficiency	Footnote
F11	Recessed 2' x 4' with Non-Planar Lenses.	2	F032/835/XP S/ECO	3500K	85.0	3100	Premium Efficiency (NEMA) Instant-Start	0.88	55	107.0909090909091	0.88	3, 4, 8
L40	8'-0" Two-lamp Profile Suspended Direct-Indirect Linear T8 Fluorescent Luminaire.	2	F032/835/XP S/ECO	3500K	85.0	3100	Premium Efficiency (NEMA) Instant-Start	0.88	110	53.54545454545455	0.85	3, 4, 8
L42	12'-0" Two-lamp Profile Suspended Direct-Indirect Linear T8 Fluorescent Luminaire.	2	F032/835/XP S/ECO	3500K	85.0	3100	Premium Efficiency (NEMA) Instant-Start	0.88	165	35.696969696969695	0.85	3, 4, 8

Basic criteria

- Practical and implementable for typical office spaces

Generic
enough to be
inclusive?



Specific
enough to be
useful?

Advanced to
save energy
beyond code?



Cost effective
and widely
available?

Puts designer
interests first?



Industry
buy in?

Commercial Lighting Solutions

Logged in as [cdilouie@zinginc.com](#)

[Log Out](#)

[Sett](#)

Untitled project

Office Design

Conference

You have no space

New Space



Add Conference Rooms Space

Now choose the control strategies you plan to apply to this space. Each template has been designed to avoid conflicts between the different strategies.



Template 1



Multilevel switching



Vacancy Sensor

[Template Details](#)



Template 2



Vacancy Sensor



Manual Dimming



Multilevel switching

[Template Details](#)



Template 3



Vacancy Sensor



Manual Dimming

[Template Details](#)



No controls strategies above those required by code will be used.

Back

Cancel

Next

Choices

Back

Next

1-2007

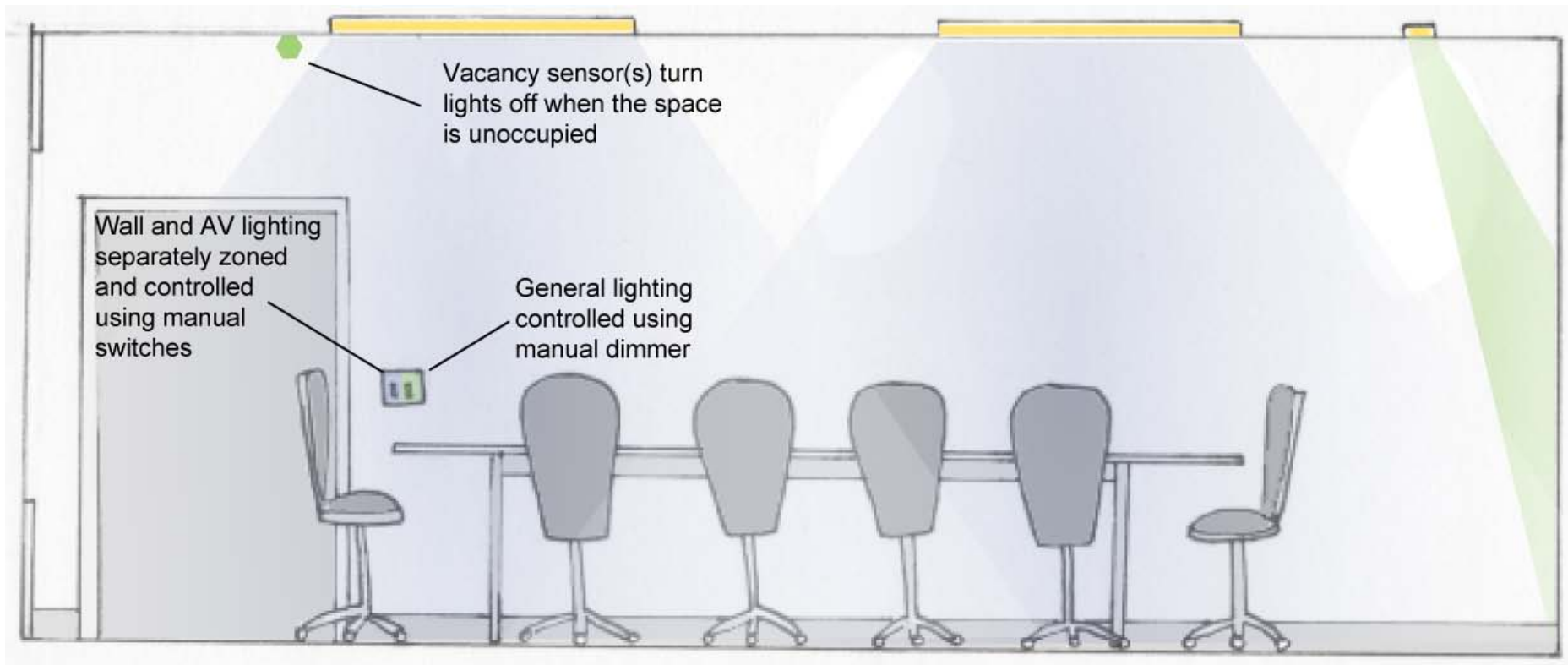
What's my code?

Baseline: 0 kWh

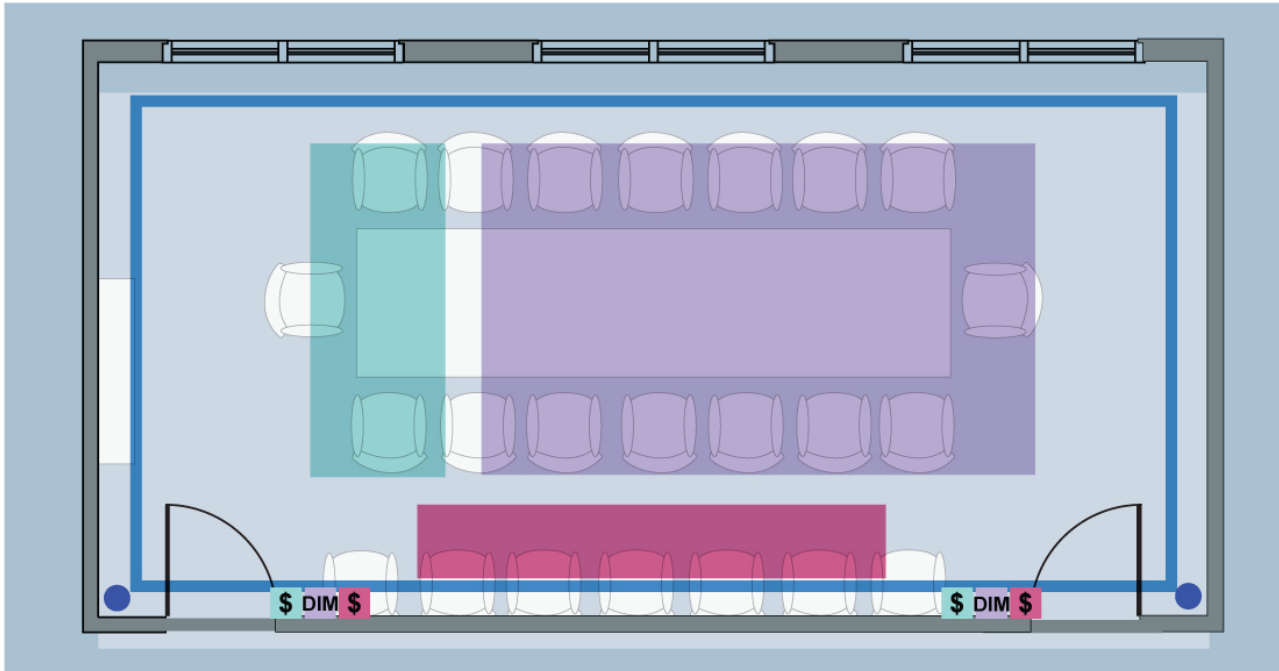
Proposed: 0 kWh

Energy Savings: 0%

Templates: Concept drawing



Templates: Zonal drawing



Control	Zone	Description
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\$

DIM

\$



AV wall zone controlled by manual switch

General lighting zone controlled by dimmer switch

Wall lighting zone controlled by manual switch

All lighting controlled by corner-mounted vacancy sensors

Guidance and implementation elements

- Concept drawing
- Control zone map
- Performance specifications
- Notes on wiring, installation, and commissioning
- Energy savings assumptions

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Commercial Lighting Solutions

Logged in as carol.jones@pnl.gov | Log Out | Settings | Help

test | Save | Copy | New Project | Select a project... | Load Project

Office Design Vignettes

Select the spaces your building will include.

Corridors

Conference Rooms

Reception

PROJECT DESCRIPTION

DESIGN VIGNETTES

Back | Next

90.1-2007 | What's my code? | Baseline: 0 kWh | Proposed: 0 kWh | Energy Savings: 0%

Office Lighting Solutions key plan